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(54) Title: UNIVERSAL FUEL FOR ENGINES

(57) Abstract

A universal fuel for internal combustion engines such as piston engines, said fuel omprising: (a) about 1% to 71% by volume of a primary, secondary or tertiary monohydric aliphatic alcohol containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof; (b) about 0.5% to 10% by volume of water; (c) from about 1% to 90% by volume of one or more vegetable oils, or mixtures thereof; and (d) from about 10% to 80% by volume of one or more ethers of the formula ROR', wherein R and R' may be the same or different and R and R' designate a C_1 to C_3 alkyl group, or mixtures thereof.

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UNIVERSAL FUEL FOR ENGINES

TECHNICAL FIELD:

This invention relates to a novel universal liquid fuel for internal combustion engines such as piston engines of any type used in land vehicles, marine piston engines, aircraft piston engines as well as stationary piston engines.

BACKGROUND ART:

As an outcome of the present energy crisis, caused inter alia by the insecure supply situation of crude oil and refined fuels derived therefrom, especially countries, which either lack, or possess insufficient resources or supplies of these fuels, numerous attempts have been and are being made to discover or develop alternative fuels, which are not based on hydrocarbon oils.

It is also well known that the natural resources and reserves of crude oil on earth are being used up and thus depleted at a constantly increasing rate, while the chances of finding hitherto unknown deposits of crudes become progressively smaller. It is therefore a safe estimate that these reserves will be practically exhausted within a century or less. The attempts to develop alternative sources or substitutes for hydrocarbon based fuels assume therefore the utmost urgency.

Substitutes for hydrocarbon fuels, which have been suggested already include fuels based mainly on alcohols, which may be derived from vegetable carbohydrates or obtained synthetically as known per se; fuels based on mixtures, emulsions or dispersions of coal and water; fuels obtained by the

liquefication of coal; gaseous hydrogen and gaseous hydrocarbons, to mention only a few.

A fuel which is adapted to serve as an adequate substitute or alternative for conventional fuels for piston engines should possess inter alia the following properties:

a) It should be obtainable from non hydrocarbonaceous raw materials, which are cheap and always available in sufficient quantities in all parts of the world;

b) It should be produced by simple processes, which moreover do not necessitate the use of complicated and expensive industrial plants;

c) The use of the novel fuels should not require technical modifications of the conventional engines in present day use; and last but not least

d) The exhaust gases of such fuels should not cause environmental problems, even taking into consideration the severe restrictions imposed by recently promulgated laws and regulations in many countries in the world.

The alternative fuels or substitutes mentioned above must stand up to all the criteria discussed above, or they are uneconomical, even at the present high prices of hydrocarbon fuels.

DISCLOSURE OF INVENTION:

It is thus an object of the present invention to provide a novel fuel for piston engines of all types (as hereinafter defined) which satisfies all the above recited criteria, and which will thus make a most important immediate and long term contribution towards solving some of the problems of the energy crisis.

A further object of the invention is to provide a novel liquid fuel composed of known materials in specified amounts which burn well in engines without substantial polution problems and which is not based on fossil fuels.

Other objects and advantages of the invention will become apparent as the description proceeds.

In satisfaction of the foregoing objects and advantages, there is provided by this invention a universal liquid fuel consisting essentially of the following constituents:

a) from 1% to 71% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, benzyl alcohol or mixtures thereof;

b) from 0.5% to 10% by volume of water;

c) from 1% to 90% by volume of one or more vegetable oils or mixtures thereof; and

d) from 10% to 80% of one or more ethers of the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group or mixtures thereof;

with the proviso that the solutions are clear solutions and do not stratify during storage or on standing.

BEST MODE FOR CARRYING OUT THE INVENTION:

Applicant has succeeded in developing a novel universal liquid fuel which is composed of raw materials which are comparatively cheap and in abundance anywhere in the world. The raw materials are moreover inexhaustible, since they are based mainly on vegetable materials or residues derived therefrom.

The expression "universal fuel for piston engines of any type" denotes in this context a fuel which is suitable for conventional piston engines of any type, such as conventional internal combustion engines as used in passenger vehicles of any type, in lorries, tracked vehicles in civil engineering and military use, marine engines, Diesel engines, radial piston engines as used in propeller driven aircraft, including helicopters, as well as turbine engines, such as used in turboprop aircraft.

The use of the universal fuel according to the invention does not appreciably alter the horse-power rating of the engines, nor does it affect the maximum velocity or the acceleration of the craft driven by the engines.

Extensive tests have also shown that the fuel has no adverse effects, such as corrosion, clogging or backfiring on the engines. The engines start immediately under all climatic conditions usually met with anywhere, and the exhaust gases are clean, i.e. they do not contain noxious or poisonous gases, vapours or solid particles, and no environmental hazards are created thereby, which means that the combustion is complete.

The invention thus concerns a universal liquid fuel for all types of piston engines, said fuel consisting essentially of:

a) 1% to 71% by volume of one or more primary, secondary and tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, benzyl alcohol or mixtures thereof;

b) from 0.5% to 10% by volume of water;

c) from 1% to 90% by volume of one or more vegetable oils, or mixtures thereof; and

d) from 10% to 80% by volume of one or more

ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof;

with the proviso that the mixtures form clear solutions, which do not undergo a phase separation on standing for a protracted period.

In a more preferred embodiment, the invention concerns a universal liquid fuel for piston engines of any type as hereinbefore defined constituted of from 50% to 66% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof, from 2.6 to 9.2% by volume of water, from 4.4% to 14.7% by volume of vegetable oils or mixtures thereof and of 13% to 40% of ethers of the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group or mixtures thereof.

The lower members of the series of alcohols defined above, i.e. methyl alcohol, ethyl alcohol, and propyl or isopropyl alcohol are preferred, while optimal results are obtained by the use of methyl and ethyl alcohol or mixtures thereof. The preferred vegetable oil is sunflower oil, the preferred alcohol is technical grade ethyl alcohol, whereby it has to be taken into account that such alcohol contains about 5% by volume of water, which has to be added to proportion of water defined above. The ether giving optimal results is diethyl ether.

The fact that ethyl alcohol, as well as some of the other members of the series of alcohols defined above can be obtained by fermentation of carbohydrates and other naturally occurring raw materials renders the use of these alcohols particularly attractive and advantageous.

The C_1 to C_3 alkyl ethers, suitable for use in the fuel, may be symmetrical or asymmetrical. Here again the lower members of the symmetrical ethers are preferred. Mixtures of these ethers are also suitable. Diethyl ether, dimethyl ether, methyl ethyl ether, n-propyl ether and isopropyl ether are preferred. Diethyl ether is especially preferred.

All the commercially available vegetable triglyceride oils are suitable for use in the inventive fuels. Examples of such oils are: sunflower oil, castor oil, soybean oil, cottonseed oil, olive oil and corn oil. Sunflower oil and corn oil are preferred. These vegetable oils are a known class and are to be distinguished from natural resinous materials such as turpentine or hydrocarbons such as lubricating oils.

The process for preparing the fuel according to the invention is simple and does not necessitate the use of a special plant or apparatus. The various components selected are mixed together in the proportions specified hereinafter. The mixture is stirred until a clear solution is obtained and then passed to storage. Appropriate precautions have to be taken to prevent explosions or fires, since most of the raw materials and particularly the fuel obtained is highly flammable and even explosive. The fuel of this invention may also be mixed with gasoline or Diesel fuel.

Dyes to impart a distinctive colour to the fuel as well as suitable odorants may be added, if desired.

Within the parameters of the broad concept of this invention, certain specific ranges of components are highly preferred depending on the type of engine in which the new fuel is to be used.

Thus, the composition is preferred for use in a Diesel engine as follows:

a) about 22% to 36% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof;

b) from about 0.5% to 9% by volume of water;

c) from about 20% to 60% by volume of one or more vegetable oils, or mixtures thereof; and

d) from about 20% to 40% by volume of one or more ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof.

The preferred formulation for use in a gasoline engine is as follows:

a) about 25% to 54% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof;

b) from about 0.5% to 9% by volume of water;

c) from about 5.5% to 41% by volume of one or more vegetable oils, or mixtures thereof; and

d) from about 15% to 38% by volume of one or more ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof.

Outstanding results are achieved when using compositions within the above formulations in the respective engines.

A number of representative examples will now be given, to illustrate a preferred embodiment of the process of preparing fuels according to the invention. It should however be clearly understood that the examples are not exhaustive, the

scope of the invention being delimited in the subsequent claims. The quantities indicated are parts by volume.

EXAMPLE I

13.16 parts of sunflower oil are admixed with 34.21 parts of diethyl ether. 25 parts of ethyl alcohol (95%) are added. The mixture is stirred until a clear solution is obtained.

A further quantity of 25 parts of ethyl alcohol (95%) is admixed with 2.63 parts of demineralized water.

Finally the two solutions thus obtained are mixed together.

EXAMPLE II

The procedure of Example I is followed, but the ethyl alcohol is replaced by identical volumes of methyl alcohol.

EXAMPLE III

The procedure of Example I is followed, but the ethyl alcohol is replaced by identical volumes of a mixture of equal parts of ethyl alcohol and methyl alcohol.

Following the procedures of Example I fuel solutions were prepared from the ingredients and the parts by volume tabulated in Table I.

TABLE I

Example No.	IV	V	VI	VII	VIII	IX
methyl alcohol %	65.81			58.77		
ethyl alcohol %		65.81	51.38		65.89	55.0
water %	7.89	7.89	2.63	2.63	7.89	7.89
sunflower oil %			14.74	4.39	9.56	
corn oil %	13.15	13.15				9.56
dimethyl ether %	13.15		31.25	34.21		
diethyl ether %		13.15			16.76	27.55

The fuels obtained as described in Examples I to IX were tested in different types of piston engines, more particularly 4 cylinder, 6 cylinder and 8 cylinder engines, and 2 stroke and 4 stroke Diesel engines. It was found that after an initial adjustment of the choke to regulate the fuel:air ratio to the optimal value for the fuel, an operation which is within the competence of every driver, the engines tested started immediately and run smoothly. No significant change of the horse power rating was observed.

EXAMPLE X

67.8 Parts of sunflower oil were admixed with 9.7 parts of technical grade ethyl alcohol, 22.3 parts of diethyl ether and 0.1 part of water. The mixture was stirred until a clear solution resulted.

Following the procedure of Example X fuel solutions were prepared from the ingredients and in parts by volume, as tabulated in Table II.

TABLE II

Constituents	Examples XI	XII	XIII	XIV
sunflower oil	89	49	10	1
technical grade ethyl alcohol	1	25	10	71
diethyl ether	10	25	80	28
water	0	1	0	0

The fuels obtained according to the procedure outlined in Examples X to XIV were tested as follows.

All the fuels were tested in a two-stroke BMW motor car.

Using fuels obtained by Examples X to XII, ignition was instantaneous; however, the horse power ratio was somewhat lower than that measured when regular motor car fuel was used and the exhaust gases contained some smoke.

Using fuels obtained according to Examples XIII and XIV in the same engine, satisfactory results were observed in all respects, i.e. ignition, smooth running, horse power rating, and clean exhaust gases.

The fuel obtained according to Example XII was also used in a heavy Mack-Diesel lorry. The results were excellent.

The invention has been described herein with reference to certain preferred embodiments. However, as obvious variations thereon will become apparent to those skilled in the art, the invention is not considered to be limited thereto.

CLAIMS:

1. A universal liquid fuel for internal combustion engines, said fuel consisting essentially of:

a) 1% to 71% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof;

b) from 0.5% to 10% by volume of water;

c) from 1% to 90% by volume of one or more vegetable oils, or mixtures thereof; and

d) from 10% to 80% by volume of one or more ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof;

with the proviso that the mixtures form clear solutions, and do not undergo a phase separation or stratification on standing for a protracted period, and burns in the engine without production of noxious gases.

2. A fuel as claimed in claim 1, in which the aliphatic alcohols are selected from the group consisting of methyl alcohol, ethyl alcohol, propyl alcohol, isopropyl alcohol or mixtures thereof.

3. A fuel as claimed in claim 1 in which the vegetable oil is selected from the group including sunflower oil, corn oil, castor oil, cottonseed oil, olive oil, soybean oil or mixtures thereof.

4. A fuel as claimed in claim 3, in which the vegetable oil is sunflower oil or corn oil or mixtures thereof.

5. A fuel as claimed in claim 1 in which the ethers are selected from diethylether and dimethyl-ether or mixtures thereof.

6. A fuel as claimed in claim 2 in which the alcohol is technical grade ethyl alcohol or methyl alcohol or mixtures thereof.

7. A universal fuel according to claim 1 consisting essentially of a) from about 50% to 66% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof, b) from about 2.6% to 9.2% by volume of water, c) from about 4.4% to 14.7% by volume of one or more vegetable oils, or mixtures thereof, and d) from about 13% to 40% by volume of one or more alkyl ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof.

8. A fuel as claimed in claim 7 wherein the vegetable oil is sunflower oil or corn oil, the aliphatic alcohol is technical grade ethyl alcohol, and the ether is diethyl ether.

9. A liquid fuel according to claim 7 for gasoline engines, said fuel consisting essentially of:

a) about 25% to 54% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohol, or mixtures thereof;

b) from about 0.5% to 9% by volume of water;

c) from about 5.5% to 41% by volume of one or more vegetable oils, or mixtures thereof; and

d) from about 15% to 80% by volume of one or more ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof.

10. A liquid fuel according to claim 7 for Diesel engines, said fuel consisting essentially of:

a) about 22% to 36% by volume of one or more primary, secondary or tertiary monohydric aliphatic alcohols containing 1 to 8 carbon atoms, or benzyl alcohols, or mixtures thereof;

b) from about 0.5% to 9% by volume of water;

c) from about 20% to 60% by volume of one or more ethers having the formula ROR', wherein R and R' may be the same or different and either of them designates a C_1 to C_3 alkyl group, or mixtures thereof.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 80/01119

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL.[3] C10L 1/06
US. CL. 44/56

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
US	44/53

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	US, A, 1,398,947, Published, 29 November 1921, Schreiber	1-10
A	US, A, 1,338,982, Published, 04 May 1920, Hayes	1-10
A	US, A, 1,495,094, Published, 20 May 1924, Morgan	1-10
A	US, A, 1,501,383, Published, 15 July 1924, White	1-10
A	US, A, 1,684,686, Published, 18 September 1928, Records	1-10
A	US, A, 2,117,610, Published, 17 May 1938, Jean	1-10
A	US, A, 3,902,868, Published, 02 September 1975, Zoch, Jr.	1-10

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"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
04 DECEMBER 1980	12 DEC 1980
International Searching Authority [1]	Signature of Authorized Officer [10]
ISA/US	MRS. V. HARRIS-SMITH

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METHOD OF PREPARING POLYOL ALKYL ETHERS

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Inventor: BEHR ARNO; SCHMIDKE HEIKO; LOHR CHRISTOPH; SCHNEIDER MICHAEL
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Cited documents:
EP0407841
EP0419077
EP0035075
DE2450667
US4675082
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Abstract of **WO9401389**

The invention concerns a method of preparing polyol alkyl ethers by reacting, under mild conditions and in the presence of acid catalysts, polyhydroxy compounds selected from the group comprising (a) alkylene glycols, (b) glycerin, (c) oligoglycerins, (d) trimethylolpropane, (e) pentaerythrite, (f) 1,12-dodecanediol and (g) sorbitol with olefins of formula (I),in which R1 is a straight-chain or branched-chain alkyl group with 1 to 6 carbon atoms and R2 is hydrogen or also an alkyl group with 1 to 6 carbon atoms.